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ABSTRACT

During the 1992-93 school year, the leadership of Benjamin Russell High School, located in Alexander City, Alabama, decided to experiment with blocked class periods. Under this option, sometimes referred to as the Copernican System, subjects are taught in double periods rather than in the conventional 50-minute periods normally used in most schools. One fewer subject is taught during any one semester. Four classes of ninth graders were chosen for the blocked treatments--one for each subject area--mathematics, science, English, and Alabama history/world geography. Data analysis included a review of students' grades. In three of the four academic areas, the performances of block students did not appear to differ significantly from those of regular-section students when preexisting student differences were controlled. Teachers initially had difficulties in planning and for students there was also an adjustment period. By the second semester, however, students expressed more positive attitudes toward the block schedule. Teachers were committed to try the block sections without having clarification on how the alternative time schedule could best be utilized. It is recommended that schools use a wider range of tools to measure student achievement. Five tables, two figures, and a master schedule are included. Contains two references. (LMI)

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The Use of Block Periods for Instruction: A Report and Evaluation

by

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The Use of Block Periods for Instruction: A Report and Evaluation

by

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In 1992-93 school year the leadership of Benjamin Russell High School, located in Alexander City, Alabama, decided to embark upon an experiment involving blocked periods. Under this option, sometimes referred to as the Copernican System (Carroll, 1990), subjects were to be taught in double periods rather than the conventional 50 minute periods normally used in most schools but one less subject would be taught during any one semester. The presumed benefits of this arrangement include:

1. More time for continuity so that teachers can develop their teaching approaches without regard to a 50 minute time limit

2. More time for extended lab or practice sessions without as much needed review.

3. Since doubling a class period means that in any given semester one less subject would be taught, this means that the load on students will be able to concentrate on fewer subjects at any one time.

4. With fewer separate classes, the teacher has fewer students to work with during the day and therefore can better monitoring student progress and provide more effective assistance

Design

For simplicity's sake only freshmen were involved in this experiment. Four classes of ninth graders were chosen for the blocked treatments: one for each subject being blocked: Mathematics (Algebra I), Science, English, and Alabama History/World Geography. Each of the blocked courses was scheduled for the first two hours of the school day so that the same material that would be covered normally during a full school year was to be covered during a single semester. Material that was ordinarily only one semester in duration (Alabama History and World Geography) was to be covered in 9 weeks. In addition, each member of one block for the first semester participated with the same classmates in another block the second semester. Thus those students who were in the Algebra I block the first semester rotated to the Science block the second semester, while those in Science block the first semester rotated to Algebra I the second semester. Those in English block

the first semester rotated to Social Studies the second while those in the Social Studies first block rotated to English.

For each subject, the teacher chose a section of the same course meeting later in the day on the usual one hour per day yearlong schedule to serve as the comparison or control group with which the block section would be compared. Thus no student was in more than one blocked course at a time but many students served as part of other control groups. No special randomized sampling procedure was used to equate the sections being blocked and those being taught in the regular format, but analysis of covariance was used to try to compensate for any initial inequalities between blocked and comparison courses[1]. Only students for whom complete information was available on all measures were included in the final results. Students who withdrew from school, who were transferred to other sections, or who entered block classes during the year were not included in the analysis.

Although there were a few cases where students in one of the block sections were also included in a regular section of a different subject matter, for the most part membership between the block and unblocked courses did not overlap. For the reader's information, Table 1 includes for each group information about their academic characteristics: the final grade the preceding year in each subject, the School Ability Index score on the last Stanford Achievement Test, and the score on the relevant subject test of the Stanford Achievement Test.

[Table 1 about Here]

As shown in Table 1, there were some initial differences between the groups as might be expected when using intact groups. In social studies, students in the two blocks were significantly lower on all of the covariates while in science just the opposite was true. In algebra, there was a slight difference on general school ability favoring the block groups, but not difference on the mathematics specific covariate measures.

Given these associations and unequal starting points, any differences in final grades in the courses cannot be taken at face value. In order to determine the effectiveness of the block approach, the final grades of the block sections and the control sections were computed and compared for each subject matter separately adjusting for the preexisting differences on the covariates. Rather than enter each of the covariates separately in the analyses, the author chose the simpler approach of pooling the three covariates into a single, overall variable designed to reduce the actual number of

variables in the analysis while controlling for these three preexisting conditions. The results of these analyses are shown in Tables 2 and 3.

Social Studies

[Table 2 about Here]

The results displayed in Table 2 indicate that the students in the regular section of Alabama History/World Geography on the average had higher final grades than those who participated in the special extended blocks. Those in the regular section had an average of 85.8 percent which was almost 14 points higher than the combined averages of the extended blocks. However, the preexisting differences on the covariates were significantly related to differences in final grades in the course, accounting for 65 percent of the differences in final grades in the course.[2] When these differences in background are controlled for and adjusted means computed as shown in Table 6, there remains no statistically significant difference between the levels of academic performance in social studies of any of the groups ($p = .66$). That is, the adjusted averages are so close to each other, that the differences probably occurred due to chance.

Since one of the assumptions of covariance is that the regression slopes between the covariate and the dependent variable is the same for all groups, a statistical test of the hypothesis of homogeneity of regression slopes was calculated with the result that the slopes were significantly different. This means that the differences between the three groups is not the same over the full range of student ability. In order to better interpret the findings, the regression lines, representing the correlation between the covariate and final grades in the course, were plotted for the three groups. These plots are shown in Figure 1. What they reveal is that for those students with average abilities and background (represented by the point 0 on the covariate axis) the difference between the block approach and the regular year long approach is minimal or nonexistent. However, as we consider those students with higher abilities (represented by those having higher covariate scores, the differences get larger and larger as student abilities increase.

[Figure 1 about Here]

What is the pattern of these differences ? Note that the regression lines of the control group and the second semester block are very similar while both diverge considerably from that of the first semester block. Although the overall difference between the groups is not significant, the pattern is still of interest. For the first semester block, the instructor taught one hour of Alabama History and then an hour of World Geography. In retrospect, however, this pattern negated one of

the supposed advantages of the blocking arrangement: the reduction in number of subjects being carried at any one time by the student. For the second semester, the instructor taught the full semester course of Alabama History in only nine weeks followed by the full semester course of World Geography during the second nine weeks. In other words the second semester block replicated the same pattern as the regular control group, except that it was at double the regular rate. Perhaps for that reason, the regression curves are very similar for the two groups. The divergence of the lines suggests that students at the upper end of the ability curve tend to receive higher grades when in the normal pattern whereas the lower ability students tend to receive higher grades when the two subjects are taught in an integrated fashion. However, the reader should note that these are only suggested patterns since the overall F ratio was not significant.

English Literature

The findings represented in Table 3 suggest that the final grades of the three sections were somewhat different -- approximately a 7 point difference between the average final grade in the extended blocks and the average final grade of the regular section. However, the table also reveals a pattern whereby differences in background, previous grades in English, general academic ability (SAI), and standardized test scores in English were also significantly related to final test scores. Even when these differences are controlled, however, the differences between group averages is still statistically significant ($p=.006$). Students taught in the extended blocks achieved higher final grades than their cohorts who took the regular section. This suggests that the extended block arrangement works better for students at BRHS than the normal schedule.

[Table 3 about Here]

As before, however, it is prudent to test for the assumption of homogeneity of regression slopes. Do the conclusions expressed above really apply to <u>all</u> students in the blocked sections compared to all students in the control group? When the test was conducted, the results again revealed a significant group-covariate interaction. Therefore the regressions between covariate and dependent variables were plotted for each of the three English groups separately and the results displayed in Figure 2. Examining the graph, a clear pattern is apparent: differences among the groups is relatively small at the high end of the student ability spectrum while at the lower ability levels students in the blocked sections received much higher grades than their lower ability peers in the control group. In other words, high ability students received about the same grades regardless of which section they were in whereas lower ability students got much higher grades if they were in

the block. As judged by grades, then, lower ability students appear to benefit more from the blocked course than do their higher ability peers.

[Figure 2 about Here]

Mathematics

According to Table 4, both block groups received somewhat higher final grades than did those in the regular group. However, differences on previous measures of mathematics achievement, including previous grades and standardized test performance as well as general academic ability, were related to how well the students performed in the course. Once the final grades in mathematics were adjusted to remove the effects of these previous differences between students, the difference between the groups was insufficient to reach significance. That is, controlling for prior differences, students in the extended sections had no higher (or lower) grades than did students in the regular sections. No significant group-covariate interactions were found and therefore these conclusions apply to all ranges of students, regardless of their ability level.

[Table 4 about Here]

As an additional measure of student learning, all students enrolled in Algebra I were also given a standardized test at the end of the year and it was of interest to see if student performance on that test was related to the section of Algebra I in which they were enrolled. The analysis is shown in Table 5. According to the information contained in Table 5, differences on the covariates were again significantly related to differences on the dependent variable. When these were controlled for, there was no significant difference between any of the groups on the special test. This means that the difference of 4.4 points between the adjusted mean of the 1st semester block and the adjusted mean of the 2nd semester block, even though there is a logical explanation, are too small to allow us to rule out chance as the cause.

[Table 5 about Here]

Science

According to the data in Table 6, although the comparison group scored almost ten points lower on the average than did students in the extended periods, this difference is almost entirely a reflection of the fact that the groups differed initially on all three of the covariates. When the effects of these differences and relationships are removed, the adjusted means of the groups are virtually identical, indicating that no differences resulted from the two approaches. Again, no

significant group-covariate interaction was found and therefore these conclusions apply to all ranges of students regardless of their ability.

[Table 6 about Here]

Discussion

To summarize the findings reported above, in three of the four academic areas, the performance of the special block students does not appear to differ significantly from that of the regular section whenever we control for the effects of preexisting differences among the students. Only in English does the extended block approach appear to have led to higher levels of academic performance--at least as they are measured by grades. Were we to use different measures of student achievement, measures such as standardized test scores, the results might be different.

It should be noted that both students and teachers experienced certain problems in the fall when the experiment first began and these problems may have a bearing on the interpretation of the final posttest comparisons. Initially, all four teachers had some difficulty in planning for the two hour blocks--not surprising given that their entire previous experience had been in the typical one hour per day, five days a week format. They reported a tendency to proceed slowly and then by midsemester to feel that they were short on time and might not be able to cover all the material they had intended. This feeling was exacerbated by the fact that on numerous days, certain other activities or assemblies were held during the first two class periods, thereby further depriving them of instructional time. Every day missed in reality counted as two days of instructional time. However, by the second semester the problems of instructional planning had been greatly reduced and teachers reported feeling much more comfortable with the block arrangement. In fact at least one indicated that she had become to comfortable with the block that she began to encounter difficulties in her other regular one hour classes.

For the students there was also an adjustment period. Unaccustomed to being in a two hour class, they reported that they missed having the opportunity to change seats and to go to the bathroom between 1st and 2nd periods. The teachers also surmised that they missed the chance to converse with friends as classes were changing. In a mid year evaluation (See Appendix C), most students reported that they felt they had less homework with the two hour block. Since they were studying one less subject at the time, this is a predictable benefit of the block system. By the second semester, students had adjusted to the new schedule and were more favorably inclined toward it than they initially had been.

Conclusion

Although these findings may at first appear somewhat disappointing, one must consider that the teachers participating in the experiment were in a difficult position. Essentially, there was a commitment to try to block sections without really clarifying how the alternative time schedule could best be utilized. Thus, the teachers really were experimenting, especially during the first semester, with how best to restructure their teaching activities. Together, with the problem of interruptions in the schedule mentioned above, it is understandable why the blocking practice perhaps did lead to better results.

Now that these teachers have some experience with extended periods, they may be in a better position to appreciate the potential advantages of the new schedule and to take fuller advantage of it during future years. Together with other "fine tuning", a more realistic assessment of the relative advantages of the extended schedule may be made in a future year. Only with more experience in the new arrangement can teachers ultimately work out how best to utilize the time available.

Another aspect might also help to arrive at a more comprehensive evaluation of the blocking approach: broaden the measures of achievement. While grades are important, the fact that both block and control groups were graded by the same individuals, all of whom were obviously aware of the experiment, means that some contamination or distortion could be present in the outcome measures. It would be helpful to broaden the measures to include not only grades but also standardized tests, common tests, or perhaps external evaluations by individuals who were unaware of who participated in the block sections and who did not.

Even if a new experiment should not result in across the board increases in student performance as measured by grades, the results of the mid year evaluation mentioned earlier clearly suggest that a majority of students found merit in the new arrangement. The students' most common observation was that they felt they had less homework than usual, presumably because they were carrying one less subject than would ordinarily be the case. As the students become more accustomed to this schedule, they also may find better ways to use the time. Informal feedback from the participating teachers indicated that the students in the extended sections were much more comfortable with the format the second semester than they were during the first semester. Certainly, there is enough evidence to warrant further trials and refinement of the extended block approach.

References

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Carroll, Joseph M. "The Copernican Plan: Restructuring the American High School." *Phi Delta Kappan*, 71 (1990), 358-365.

Notes

1. It is common for researchers to employ covariance analysis in research designs in which intact, nonrandom groups are used and where the goal is to take account of these preexisting differences between the groups when comparing the groups on the dependent variable. Strictly speaking, however, covariance analysis was developed for use in designs where sampling was random but where the researcher wished to take account of additional information (represented by the covariate) on the subjects to reduce the unexplained variability and thereby increase the power of the analysis. According to Kerlinger and Pedhazer (1973, p. 266), when groups have not been constituted randomly, "analysis of covariance can be misleading and should therefore be used with caution."

Another assumption of covariance is that the treatment variable and the covariate(s) are not related--an assumption which in this study, as in so many others, is not met. As is shown later in this report, the groups differed significantly on all the covariates. In spite of these and other limitations, covariance remains the only technique which has been used to control for initial differences between groups and between individuals and therefore is employed here, albeit with due caution.

2. This estimate was achieved by using ordinary regression methods. Although the calculations are not shown here, when the pooled covariate was entered into the prediction equation, it yielded an R of .81 ($p < .001$) and therefore $R^2 = .65$.

Table 1

Initial Differences on Covariates

Subject Area	Grades	School Ability Index	Stanford Sub Test
Social Studies	B1, B2 < C**	B1, B2 < C**	B1, B2 < C**
English	n.s.	n.s.	n.s.
Algebra I	n.s.	B1, B2 > C*	n.s.
Science	B1, B2> C**	B1, B2> C**	B1, B2> C**
B1 = 1st Sem. Block	B2 = 2nd Sem. Block	C = Control Group	
* p < .01	** p < .001		

Table 2
Final Grades in Alabama History/World Geography

	1st Semester Block	2nd Semester Block	Regular Section	Total
Average Grade	72.9	71.1	85.8	78.3
Standard Deviation	6.1	17.8	12.4	
Number of Students	18	19	31	64
Adjusted Average	79.5	76.9	78.4	

Covariance Analysis of Final Grades
Controlling for Initial Differences on School Ability Index (SAI), Stanford Achievement Test -Social Studies Subtest (STANINE), and Previous Grades in Social Studies (PREVGPA)

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Covariates	9235.031	1	9235.031	120.255	.000
SSCOVAR	9235.031	1	9235.031	120.255	.000
Main Effects	65.302	2	32.651	.425	.655
GROUP	65.302	2	32.651	.425	.655
Explained	9300.333	3	3100.111	40.368	.000
Residual	4914.902	64	76.795		
Total	14215.235	67	212.168		

Figure 1

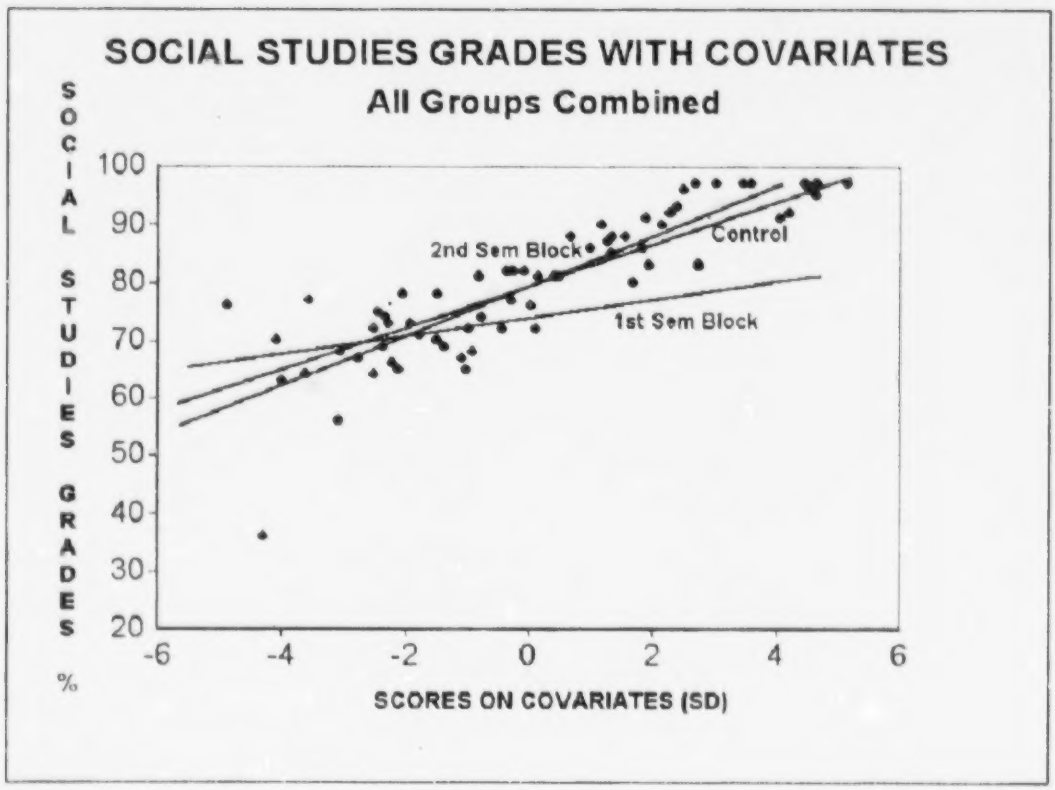
SOCIAL STUDIES GRADES WITH COVARIATES
All Groups Combined
SOCIAL STUDIES GRADES %
100
90
80
70
60
50
40
30
20
-6
-4
-2
0
2
4
6
2nd Sem Block
Control
1st Sem Block
SCORES ON COVARIATES (SD)

Table 3
English Literature

	1st Semester Block	2nd Semester Block	Regular Section	Total
Average Grade	69.3	69.4	61.8	66.3
Standard Deviation	13.3	6.0	20.5	
Number of Students	19	18	26	64
Adjusted Average	70.8	69.9	60.5	

Covariance Analysis of Final Grades
Controlling for Initial Differences on School Ability Index (SAI), Stanford Achievement Test -English Subtest (STANINE), and Previous Grades in English (PREVGPA)

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Covariates	5980.726	1	5980.726	45.694	.000
ENGCOV	5980.726	1	5980.726	45.694	.000
Main Effects	1470.869	2	735.435	5.619	.006
GROUP	1470.869	2	735.435	5.619	.006
Explained	7451.595	3	2483.865	18.977	.000
Residual	7722.342	59	130.887		
Total	15173.937	62	244.741		

Figure 2

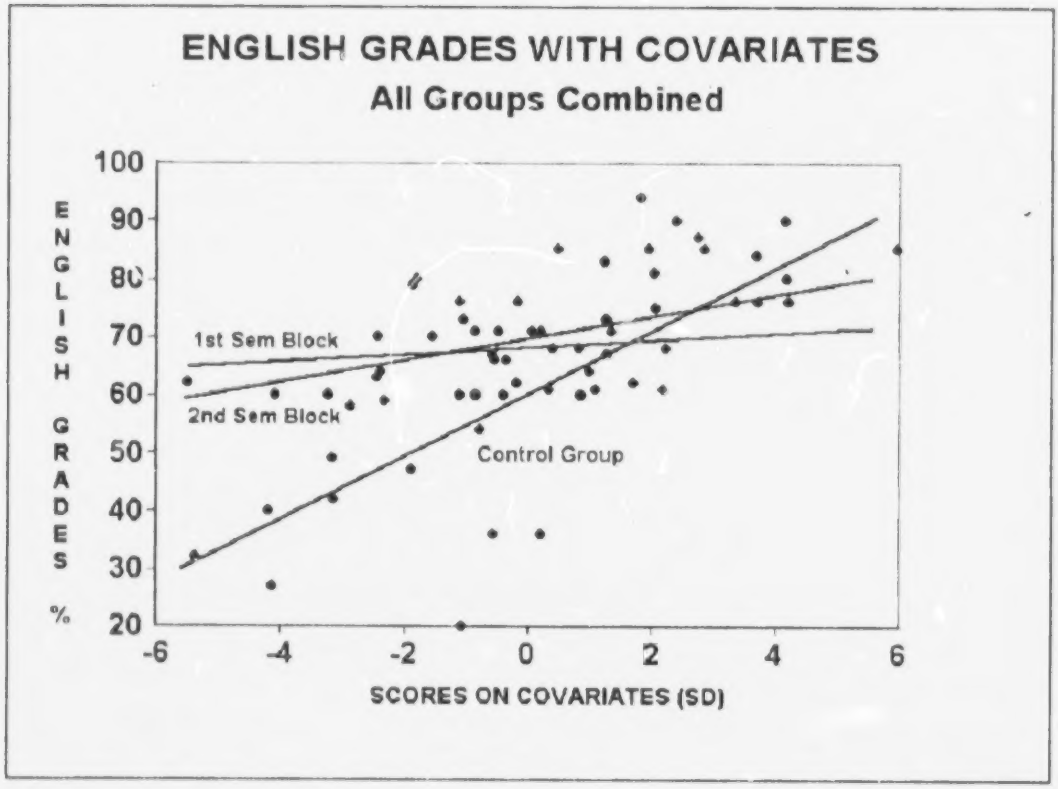
ENGLISH GRADES WITH COVARIATES
All Groups Combined
ENGLISH GRADES %
100
90
80
70
60
50
40
30
20
-6
-4
-2
0
2
4
6
SCORES ON COVARIATES (SD)
1st Sem Block
2nd Sem Block
Control Group

Table 4
Final Grades in Algebra I

	1st Semester Block	2nd Semester Block	Regular Section	Total
Average Grade	79.7	80.1	71.8	77.00
Standard Deviation	10.4	9.1	11.5	
Number of Students	17	18	23	61
Adjusted Average	78.3	78.0	74.7	

Covariance Analysis of Final Grades
Controlling for Initial Differences on School Ability Index (SAI), Stanford Achievement Test -Mathematics Subtest (STANINE), and Previous Grades in Mathematics (PREVGPA)

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Covariates	3859.599	1	3859.599	66.678	.000
ALGCOV	3859.599	1	3859.599	66.678	.000
Main Effects	159.378	2	79.689	1.377	.261
GROUP	159.378	2	79.689	1.377	.261
Explained	4018.978	3	1339.659	23.144	.000
Residual	3299.383	57	57.884		
Total	7318.361	60	121.973		

Table 5
Algebra I Special Test

	1st Semester Block	2nd Semester Block	Regular Section	Total
Average Score	23.7	28.4	24.7	25.6
Standard Deviation	11.4	5.6	4.2	
Number of Students	18	20	22	60
Adjusted Average	23.3	27.7	25.7	

Covariance Analysis of Special Test Scores
Controlling for Initial Differences on School Ability Index (SAI), Stanford Achievement Test -Mathematics Subtest (STANINE), and Previous Grades in Mathematics (PREVGPA)

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Covariates	435.321	1	435.321	8.682	.005
ALGCOV	435.321	1	435.321	8.682	.005
Main Effects	181.141	2	90.570	1.806	.174
GROUP	181.141	2	90.570	1.806	.174
Explained	616.462	3	205.487	4.098	.011
Residual	2807.721	56	50.138		
Total	3424.183	59	58.037		

Table 5
Science

	1st Semester Block	2nd Semester Block	Regular Section	Total
Average Grade	82.4	82.2	72.9	78.4
Standard Deviation	4.2	5.2	11.3	
Number of Students	20	18	27	65
Adjusted Average Grade	78.4	78.6	78.3	

Covariance Analysis of Science Grades
Controlling for Initial Differences on School Ability Index (SAI), Stanford Achievement Test -Science Subtest (STANINE), and Previous Grades in Science (PREVGPA)

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Covariates	2639.424	1	2639.424	56.184	.000
SCICOV	2639.424	1	2639.424	56.184	.000
Main Effects	.700	2	.350	.007	.993
GROUP	.700	2	.350	.007	.993
Explained	2640.124	3	880.041	18.733	.000
Residual	2865.661	61	46.978		
Total	5505.785	64	86.028		

Benjamin Russell High School
Master Schedule
1994-95

Department MATH

Teacher	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7
BLAIR	BLOCK BUSINESS MATH		Pre Calc	Pre Calc	Algebra I	Algebra I	Instruct PLAN
FOSHEE	Algebra II	Algebra II	BLOCK TRANS ALGEBRA		Instruct PLAN	Applied Math I	Cheer
DOSS	Geom	Geom	Instruct PLAN	Trans Algebra	Algebra I	Trans Algebra	Trans Algebra
MONCRIEF	Deten Super	Applied Math I	BLOCK GEOMETRY		Instruct PLAN	BLOCK GEOMETRY	
RIDDLE	Instruct PLAN	Applied Math I	Applied Math I	Super Comp	Applied Math I	Applied Math II	Cheer
SILVER	BLOCK ALGEBRA I		Trans Algebra	Applied Math I	Instruct PLAN	BLOCK ALGEBRA I	
WASHBURN	AP CALCULUS		Algebra II	Trans Algebra	Trans Algebra	Instruct PLAN	Algebra II